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Matching Unemployed and Vacancies at the Public Employment Office

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Abstract: Public employment offices match job seekers and vacancies. The effectiveness of this matching process depends on the way these offices handle the job vacancies. This article studies the matching process by analyzing the effect of different mediation methods on the duration of job vacancies. The results suggest that intensive mediation reduces average vacancy duration, indicating that public employment offices can improve the matching process.

JEL Classification System-Numbers: C41, J41, J63

1 Introduction

Like in many European countries employers in the Netherlands have no legal obligation to inform the public employment offices about their job vacancies. There are other channels which employers may use to recruit new employees: Personnel advertisements in a newspaper are a popular way to attract applicants. Employers also frequently use informal methods like notifying friends and relatives or waiting for spontaneous applications. Informal recruitment channels are said to be highly effective in terms of the match between worker and job, because both employer and new employee gather important information on each other. Friends and colleagues provide valuable information to the worker on the working conditions in the firm and to the firm on the attitude of the applicant. An advertisement usually attracts many applicants which may not all be suitable for the job. An advertisement is not only expensive in direct advertising costs but also in screening costs.

The Dutch public employment offices provide employers with applicants without any direct costs. Yet, this recruitment channel is not very popular. From a vacancy survey of the Dutch Central Bureau of Statistics (CBS) held in March 1990 it appeared that some 30% of all existing vacancies was notified at the public employment office. From a survey of the Dutch Ministry of Social Affairs and Employment it appeared that about 10% of the flow of filled job

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vacancies originated from the public employment offices. There are several reasons for this low market share. Almost all workers which register at the public employment office as job seekers are unemployed. They are obliged to register at the public employment office if they want to receive unemployment benefits. Unemployed may not all be equally motivated in accepting a job, if one is offered. Employers frequently complain about the service of the public employment offices: the applicants are often not very suitable for the job in either ability or motivation. Employers seeking for new employees therefore often only use the public employment office as an additional recruitment channel.

This article studies the matching of unemployed workers and vacancies by analyzing the duration of vacancies notified at public employment offices in the Netherlands. The matching process is described by a so called matching function, which specifies the number of matches as a function of the number of job seekers and the number of vacancies. (Blanchard and Diamond (1989)):

$$F = m(N, V) \qquad m_n > 0 \qquad m_v > 0 \qquad [1]$$

in which: F = flow of filled vacancies
N = number of job seekers
V = number of vacancies

The matching function reflects many factors, like information imperfections, the geographical and skill distribution of jobs and workers and search intensities. A matching function is a convenient way of summarizing the effects of these factors on the speed of job formation (Pissarides (1990)).

The public employment offices can choose between different mediation methods to get a notified vacancy filled. The easiest way is simply to put the vacancy information in a file which is accessible to job seekers. There are other methods differing in intensity and costs, ranging from notifying job seekers to preselection and screening of job seekers. The mediation method chosen will influence the efficiency of the matching process because the method is part of the matching technology. By analyzing the effects of the applied mediation methods on the duration of the vacancies, we can look inside the 'black box' (Blanchard and Diamond (1992)) of the matching process.

If the matching function has constant returns to scale it may be respecified as a relationship between vacancy durations and unemployment durations (Jackman, Layard and Pissarides (1989)). Then an increase in the efficiency of the labour market can be measured as an inward shift of this relationship. If public employment offices can reduce the duration of the notified vacancies by improving the matching technology they increase the efficiency of the labour market by reducing both the number of vacancies and the number of unemployed.

We use vacancy information from 5 regional Dutch public employment offices. The database contains information about vacancies notified in the first quarter of 1988. The offices have registered the completed duration of the job vacancy. Furthermore they have registered whether or not they themselves were responsible for the filling of the vacancies. Finally there is information about the

mediation methods the offices used to fill the vacancy. The article is set up as follows. In section 2 we present some information on the Dutch labour market and a brief survey on empirical studies on employers' search. We also discuss the way the public employment offices handle job vacancies. Section 3 discusses the data and the explanatory variables used in the analysis. Section 4 discusses the empirical model which we use to analyze the data and discusses the estimation results. Section 5 concludes.

2 Public Employment Offices and the Dutch Labour Market

2.1 The Dutch Labor Market

The Dutch labour market of the 1980s is characterized by a sharp increase in unemployment in the beginning and a steady decline afterwards. As shown in table 1 unemployment reached its highest level in 1984. In september 1984 822.000 workers were registered as unemployed at the public employment offices. From 1984 on unemployment declined to a level of 660.000 in september 1989.[2]

Table 1. Developments in unemployment and vacancies in the Netherlands

	number unempl. (*1000)	number vacancies (*1000)	vacancy duration (months)	notified publ. e.o. (%)	advert isement (%)
Oct '80	325	52.1	2.1	63	70
Oct '81	485	26.8	1.5	52	60
Oct '82	655	17.6	1.0	45	43
Oct '83	801	23.6	0.9	39	49
Sep '84	822	34.6	1.2	41	48
Jan '86	711	66.2	1.4	43	61
Jan '87	686	70.2	1.3	33	57
Jan '88	682	64.5	1.2	36	54
Sep '89	660	92.5	1.5	40	58

Source: CBS Vacancy Surveys
Ministry of Social Affairs and Employment
Vacancy durations: authors calculations

[2] Recent official unemployment figures are substantially lower. These official figures are available since 1987 and based on both registration of unemployed workers at the public employment office and information from labour force surveys to correct the registration figures. Officially there were about 350.000 unemployed at the end of 1989.

Information on job vacancies in the Netherlands is gathered by means of vacancy surveys, which are held by the CBS about once a year. In these vacancy surveys a job vacancy is defined by asking the employer: Do you have at this moment job vacancies for which you are searching employees whom you want to put to work immediately or as soon as possible? Note that this definition implies that a vacancy does not necessarily refer to an unoccupied job.

From table 1 it appears that the number of job vacancies decreased substantially in the beginning of the 1980s. In October 1980 there were about 50.000 vacancies, which due to the economic recession decreased to 18.000 in October 1982. From 1983 on the increase in labour demand caused an increase of the number of vacancies. In January 1986 there were some 65.000, a number which did not change very much till January 1988. In 1989 there was again a sharp increase in the number of vacancies. The average vacancy duration decreased especially in the beginning of the 1980s, from more than 2 months in October 1980 to less than 1 month in October 1983.

Table 1 also contains two indicators of employers' recruitment behaviour: the share of vacancies notified at the public employment office and the share of vacancies for which a personnel advertisement was placed. It appears that with the decrease in the number of vacancies and the increase in unemployment the use of both recruitment channels has decreased. Apparently it was possible to fill vacancies with less intensive employers' search. The use of personnel advertisements to recruit new employees has increased after 1984, while the use of public employment offices remained at a low level. In other words: the economic recovery of the Netherlands which led to an increase in employers' recruiting efforts has not stimulated the use of public employment offices.

2.2 Searching for New Employees

Employers' search is the demand side equivalent of job search, which has been investigated intensively, both theoretically and empirically (Devine and Kiefer (1990)). There have not been many empirical studies on employers' search and job vacancies. Beaumont (1978) analyzed the durations of job vacancies using data on the outflow of vacancies registered at public employment offices. He found vacancy durations for unskilled jobs and construction industry and services sector jobs to last shorter than average, while vacancies for metal industry jobs lasted longer. Beaumont distinguished between filled and cancelled vacancies, the former being vacancies filled by the public employment offices, the latter being vacancies not filled by the public employment offices. Roper (1988) used data from an employers' survey in which employers were asked about details of their most recent and in some cases their two most recent hires. He analyzed the impact of recruitment method on vacancy duration and concluded that informal recruitment methods are fastest, while national newspaper adver-

tisements are slowest. A study on employers' search by Barron, Bishop and Dunkelberg (1985) used information from surveys in which employers were asked about their screening and interviewing activities associated with the last employee hired prior to the survey. These studies investigate the effect of different factors on employers' search, measured by the number of applicants interviewed prior to an employment offer and the average number of hours spent by an employer recruiting, screening and interviewing per applicant interviewed. Larger employers appear to interview more applicants per employment offer, while for vacancies on a higher educational level employers spend a larger number of hours recruiting, screening and interviewing applicants.

Van Ours and Ridder (1992) concluded that employers search nonsequential: almost all vacancies are filled from a pool of applicants that is formed shortly after the posting of the vacancy, so vacancy durations should be interpreted as selection periods and not as search periods for applicants. The hazard rate of vacancies being filled is low in the first few weeks and increases afterwards to remain quite stable. Van Ours and Ridder (1993) explicitly decompose a vacancy duration into an application period and a selection period and analyze the determinants of both periods.

To obtain an initial pool of applicants the employer will actively solicit applications. For that he can use formal recruitment channels like the public employment office or an advertisement in a newspaper, but he may also use an informal recruitment channel like employee referral. Employers often have a strong preference for using informal recruitment channels, for a variety of reasons: they are costless, provide good initial screening and provide applicants from the neighbourhood in which the firm is located. Furthermore they give potential applicants more information than an advertisement in a newspaper, which may improve the quality of the match between workers and jobs. Though friends, relatives and personal contacts are an important source of information and help to workers seeking jobs (Corcoran, Datcher and Duncan, 1980) a lot of employers use formal recruitment channels. These formal channels have their own advantages and disadvantages. Advertising is expensive for the employer but provides the job-searcher with low-cost information concerning the existence and location of a vacancy. Advertisements therefore generally attract many applicants, though not all of them are suitable for the vacant job. The problem facing the employer is not to get in touch with the largest possible number of potential applicants; rather it is to find a few applicants promising enough to be worth the investment of thorough investigation (Rees, 1966). The use of public employment offices is costless but there are frequent complaints about sluggishness and poor screening. The public employment office is not very popular with employers. Employers are especially dissatisfied with the quality of the applicants sent by the public employment office and dissatisfied with the slowness in which this happens. With respect to the quality, the employers are dissatisfied with both the gap between abilities of applicants and job requirements as well as with the motivation of the applicants. Barron and Mellow (1982) argue that few employers use the free service of the public employment office

because applicants sent by the public employment office have a lower likelihood than other applicants of accepting employment. Therefore using public employment office services has higher screening costs per vacancy.

2.3 Public Employment Offices Handling Job Vacancies

Public employment offices use different methods of mediation to get the notified vacancies filled. The Dutch public employment offices use a classification of four groups: Selfselection, conditional selfselection, administrative matching and selective matching.

In the case of selfselection and conditional selfselection the public employment office is rather passive in its mediation. With selfselection information on both job seekers and vacancies is recorded in files, to which both employers and job seekers have access. Unemployed workers registered at the public employment office are not obliged to apply for the vacancies. Conditional selfselection mainly consists of providing vacancy information by telephone or by files. Job seekers can gather information by telephone on a few vacancies recorded on tape. If they are interested they can inform the public employment office and in some cases they will be invited to the office for an initial screening. If a job seeker is expected to be suitable for the job he or she gets the name and address of the employer. The (unemployed) job seeker is not obliged to apply.

Administrative matching means that the vacancy information is matched with information about registered job seekers. If there are possibly suitable job seekers registered, these job seekers are notified about the job vacancy. There is therefore some obligation for the job seeker to apply for the vacancy. The employer may get the names of the possibly suitable job seekers and may contact these himself.

Selective matching means that additional to administrative matching the public employment office screens the possibly suitable job seekers with respect to ability, working experience, education, motivation etcetera.

The costs of the mediation methods differ substantially. Selfselection and conditional selfselection require the least time for the public employment office. The office provides information on vacancies to the job seekers and spends no or just some time on the selection of candidates. We consider both methods extensive mediation methods. Administrative matching takes more time. The employment office has to find suitable job seekers matching the vacancy. Selective matching takes most time. Apart from the matching the employment office has to spend time in screening suitable candidates. We consider both administrative matching and selective matching intensive mediation methods.

To describe the matching process within the public employment offices we use a matching function with constant returns to scale. This is both a reasonable assumption and a frequent empirical observation (Blanchard and Diamond

(1992)). In modelling the filled vacancies who 'flow out' of an employment office we have to distinguish two processes. First, there are vacancies which are filled due to mediation activities of the public employment office. Second, since employers use additional search channels some of the notified vacancies are filled otherwise. The former flow will be influenced by the mediation activities of the employment office, the latter not. Furthermore both flows will be influenced by the number of job seekers and vacancies using the employment office and other search channels. We specify the total flow of filled vacancies as the sum of two constant returns to scale Cobb-Douglas matching functions:

$$F = \lambda_1 \cdot N_1^{\alpha 1} \cdot V_1^{1-\alpha 1} + \lambda_2 \cdot N_2^{\alpha 2} \cdot V_2^{1-\alpha 2} \qquad [2]$$

in which: $N_1(N_2)$ = number of job seekers at (outside) the public employment office
$V_1(V_2)$ = number of vacancies at (outside) the public employment office
$\lambda_1(\lambda_2)$ = efficiency parameter of the matching process at (outside) the public employment office
$\alpha_1(\alpha_2)$ = parameter of the matching function of (outside) the public employment office

We assume that the number of job seekers at the employment office is equal to the number of registered unemployed:

$$N_1 = U \qquad [3]$$

And, we assume that the ratio of job seekers to vacancies using the employment office is the same as the ratio outside the employment office:

$$N_2 = \rho \cdot N_1$$
$$V_2 = \rho \cdot V_1 \qquad [4]$$

Then, we may write [2] as:

$$F = \lambda_1 \cdot U^{\alpha 1} \cdot V_1^{1-\alpha 1} + \lambda_2 \cdot \rho U^{\alpha 2} \cdot V_1^{1-\alpha 2} \qquad [5]$$

The rate at which notified vacancies are filled is equal to:

$$\theta = F/V_1 = \lambda_1 \cdot (U/V_1)^{\alpha 1} + \lambda_2 \cdot \rho (U/V_1)^{\alpha 2} \qquad [6]$$

We interpret this rate θ as a hazard rate, equal to the sum of the hazard rate of notified vacancies filled by the public employment office (θ_1) and the hazard rate of notified vacancies filled by the use of a different recruitment channel (θ_2). So:

$$\theta = \theta_1 + \theta_2 \qquad [7]$$

Therefore, to analyze durations of filled notified vacancies we can use a competing risk model (See Han and Hausman (1990), Jensen and Westergard-Nielsen (1990) Narendranathan and Stewart (1990) for recent examples of competing risk studies).

3 Data and Variables

3.1 Data

Public employment offices have filled Dutch job vacancies for many decades. Until recently however no systematic analysis was done on the effectiveness of different mediation methods. As a preliminary step to such an analysis the registration of vacancies has been automatized since the end of 1987, using a programm called ARVA (Automatic Registration of Vacancies). The public employment offices were however not obliged the use the ARVA-system. At the start of the registration project only a few offices participated.

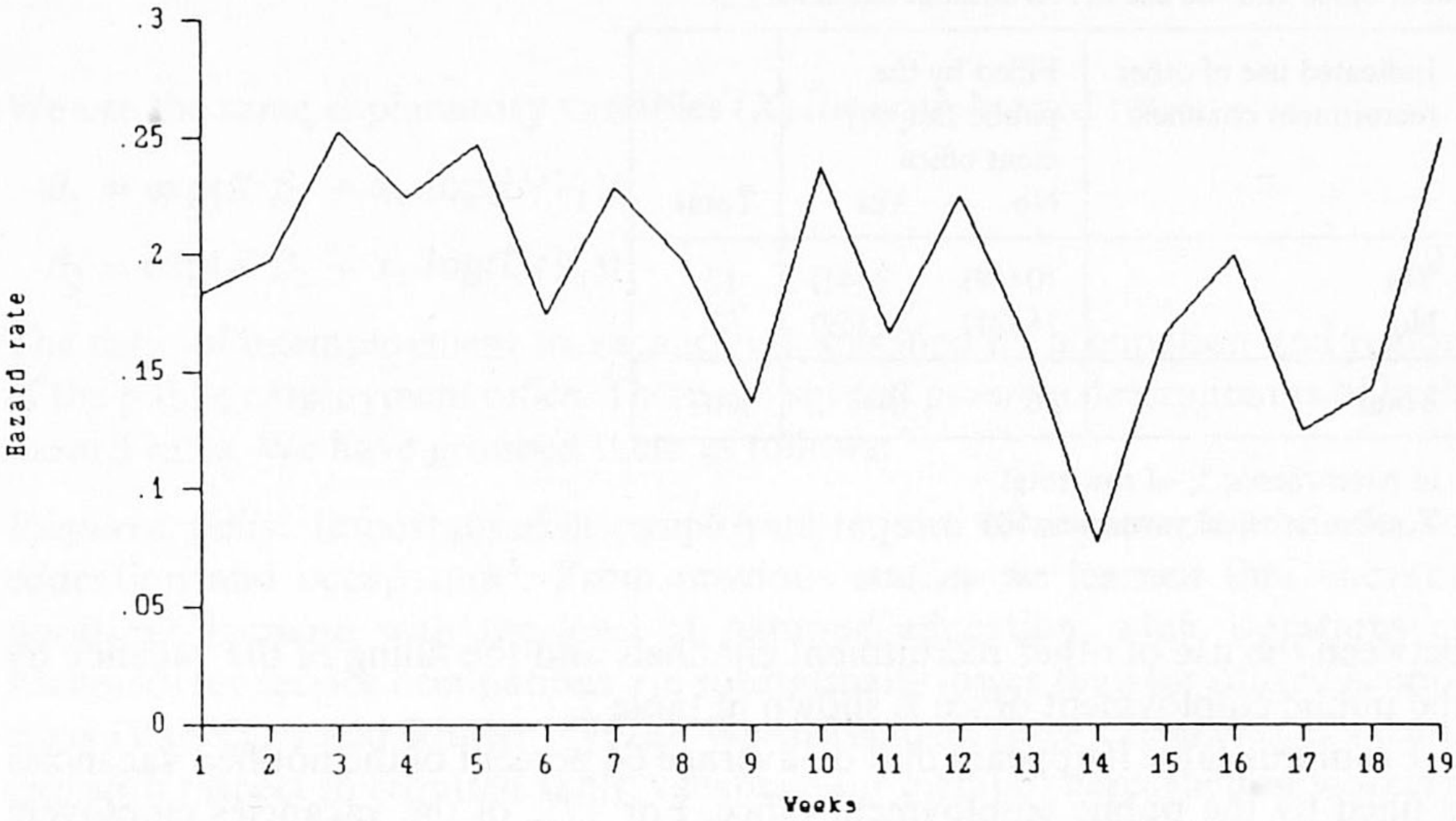
We use a sample from 5 public employment offices of 501 vacancies, who were notified in the first quarter of 1988 and refer to single – one person wanted – vacancies. For each vacancy we know the duration as measured by the time between the date of notification of the vacancy and the date it was filled. Furthermore we know what mediation method was applied, whether is was filled by the public employment office or otherwise, etcetera (Appendix 1 and 2 provide more information on the data).

As described in section 2 vacancies notified at the public employment office may be filled by the office itself or by another recruitment channel like an advertisement. The latter possibility occurs if the employer uses more recruitment channels than just the public employment office. The vacancy may end because it is filled, either by an applicant send by the public employment office or by an applicant who contacted the employer by another recruitment channel. Since there are two ways in which a vacancy can end we use a competing risk model to analyze vacancy durations.

Sample hazard rates on a weekly basis are shown in figure 1. These hazard rates are calculated as the number of vacancies filled in a period divided by the number of vacancies still unfilled at the beginning of that period. As shown in figure 1 the total sample hazard rate fluctuates over the duration of the vacancies, but there is no clear upward or downward trend. The average hazard rate varies from 0.15–0.25, while there is no obvious duration dependency. The dual risk hazard rates differ in the beginning of the vacancies. The hazard rate for vacancies filled by the public employment office decreases somewhat, which may be due to heterogeneity: the 'best' vacancies being filled first. The hazard rate for vacancies filled by other recruitment channels increases rapidly in the first 2 weeks, and increases somewhat more afterwards.

When employers notify a vacancy to the public employment office they have to indicate whether or not they are using other recruitment channels to fill the vacancy. After the vacancy is filled, the employment office establishes whether or not this was due to the mediation of that employment office. The relationship

a. Single risk hazard rates



b. Dual risk hazard rates

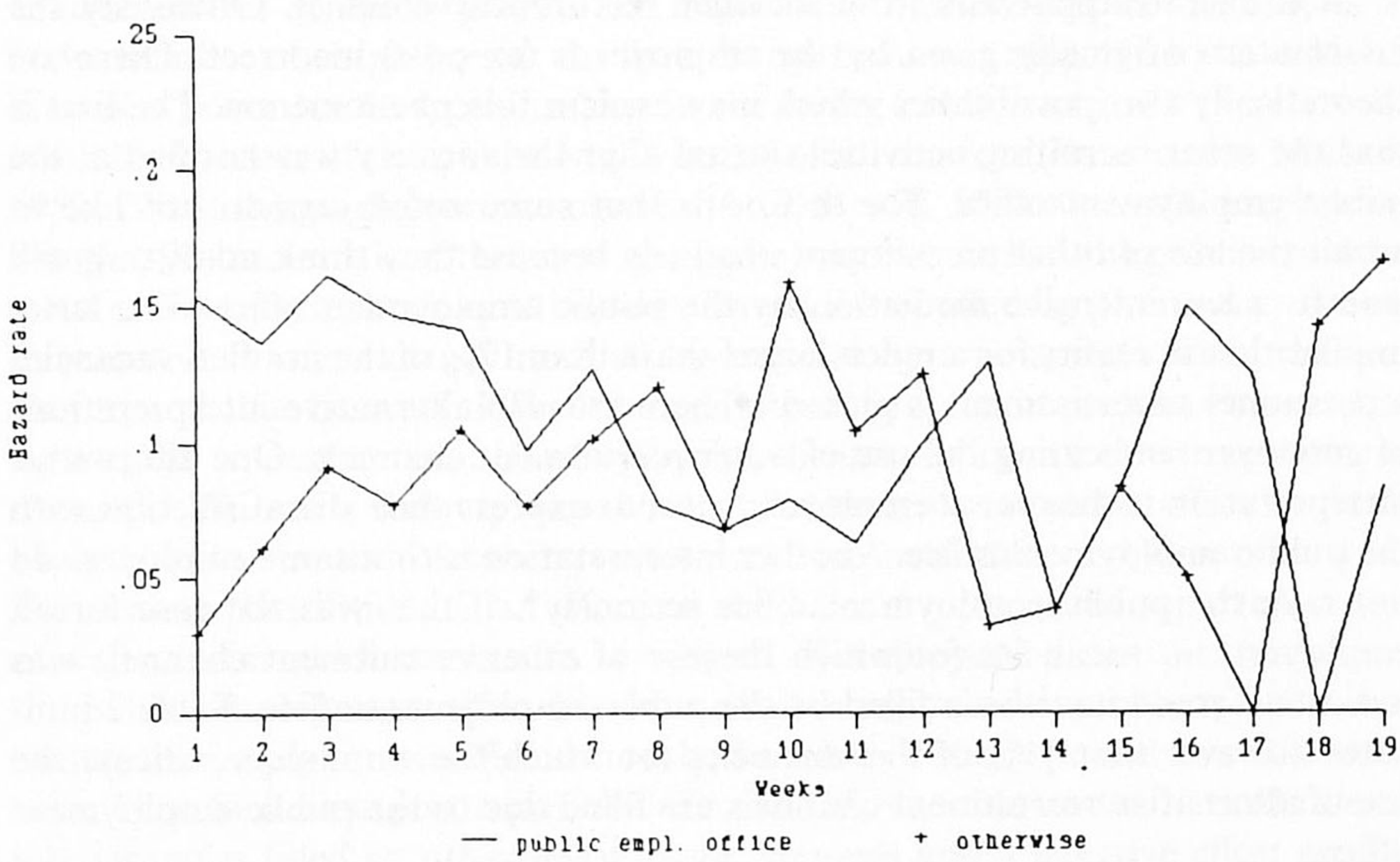


Fig. 1. Sample hazard rates for vacancies filled by the public employment office and otherwise filled

Table 2. Filling of job vacancies by the public employment office and the use of recruitment channels (%)

Indicated use of other recruitment channels	Filled by the public Employment office No	Yes	Total
Yes	10 (59)	7 (41)	17
No	26 (31)	57 (69)	83
Total	36	64	100

in parentheses: % of row total
Total number of vacancies: 501

between the use of other recruitment channels and the filling of the vacancy by the public employment office is shown in table 2.

From this table it appears that on average 64 percent of the notified vacancies is filled by the public employment office. For 17% of the vacancies employers indicate the use of other recruitment channels. However, 31% of the vacancies for which the employer does not indicate the use of other recruitment channels is filled due to applicants from another recruitment channel. Obviously the information originally given by the employer is (ex post) incorrect. There are theoretically two possibilities which may explain this phenomenon. The first is that the other recruiting activities started after the vacancy was notified at the public employment office. The second is that some employers do not like to admit the use of other recruitment channels because they think admitting will lead to a less intensive mediation by the public employment office. The latter implies that in reality for a much larger share than 17% of the notified vacancies a personnel advertisement is placed[3]. There are also alternative interpretations of employers indicating the use of other recruitment channels. One alternative interpretation is that some employers want to express their dissatisfaction with the public employment office. Another interpretation is that some employers do not take the public employment office seriously[4]. If that was the case for all employers, no vacancies for which the use of other recruitment channels was indicated would have been filled by the public employment office. Table 2 indicates however that 41% of the vacancies for which the employers indicate the use of alternative recruitment channels are filled due to the public employment office.

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[3] That this is a plausible assumption may be derived from the CBS vacancy survey of January 1987, from which it appeared that for no less than 70% of the stock of notified vacancies also a personnel advertisement was placed in a newspaper or magazine.

[4] Due to collective bargaining agreements some employers are obliged to notify their vacancies at the public employment office.

3.2 *Variables*

We use the same explanatory variables (X) for both hazard rates:

$$\theta_1 = \exp(X'\beta_1 + \alpha_1 \cdot \log(U/V_1))$$
$$\theta_2 = \exp(X'\beta_2 + \alpha_2 \cdot \log(U/V_1)) \quad [8]$$

The ratio of unemployment to vacancies is specified by occupation and region of the public employment office. There are several possible determinants of both hazard rates. We have grouped them as follows:

Required skills: Important skills employers require of new employees refer to education and occupation[5]. From previous studies we learned that vacancy durations increase with the level of required education, while durations of vacancies for service occupations are substantially lower than for other occupations (Van Ours and Ridder (1992a). We distinguish three categories of vacancies with respect to required skills: vacancies for metal or construction workers, vacancies for service occupations at a secondary or higher educational level and other vacancies.

Characteristics of the employer: An important characteristic of the employer is the number of employees at the firm. Large firms are expected to have lower interview costs due to specialization in the hiring process and will therefore be more likely users of the public employment office services (Barron and Mellow, 1982). We distinguish four size classes: 0–10, 10–50, 50–100, >100 employees. Another characteristic of the employer is the way she notifies the public employment office: by telephone or otherwise. Vacancies notified by phone may be less informative than a vacancy notified by letter or by a personal visit of the employer, and thus be more difficult to mediate. Finally an important characteristic may be whether or not the employer indicates the use of other recruitment channels. We use a dummy variable to take care of a possible effect on both hazard rates: 1 = use of other recruitment channels indicated, 0 = otherwise. We assume that if there is an effect on the hazard rates of the reported use of other recruitment channels, this is a signal of employers' dissatisfaction about the public employment office. Such an effect is an indication of employers not taking the employment office seriously, because of the expected low effectiveness. Therefore we expect a positive effect of this variable on the hazard rate of job vacancies filled by other recruitment channels and a negative effect on the hazard rate of job vacancies filled by the public employment office.

Characteristics of the vacant job: Characteristics like temporary or parttime job may be less attractive to job seekers and may thus lead to longer vacancy

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[5] Unfortunately the ARVA database does not contain information on required working experience.

durations. Whether or not there are maximum or minimum age requirements may lower the potential pool of job seekers and thus lead to longer vacancy durations. For all three characteristics we use dummy variables to analyze the effects mentioned.

Local conditions: Apart from local labour market conditions the functioning of the public employment offices themselves may be important. To investigate the latter we again use dummy variables.

Mediation method: Public employment offices apply mediation methods differing in intensity of mediation, matching of job seekers and vacancies and screening of potential applicants. We assume that the use of a specific mediation method is not endogenous with respect to the process by which the vancancies are filled. To investigate whether or not intensive mediation is worth while we use dummy variables for administrative matching and for selective matching. We expect the mediation methods to influence θ_1 and to have no effect on θ_2, since the employment offices have no influence on the matching process outside their office.

4 Estimation Results

We started our analysis by estimating a single risk hazard model, in which no distinction is made in the way the vacancies were filled:

$$\theta = \exp(X'\beta + \alpha \cdot \log(U/V_1)) \qquad [9]$$

Assuming that there is no duration dependency and no unobserved heterogeneity, the completed vacancy durations have an exponential distribution and the likelihood can be specified as:

$$L = \prod_{i=1}^{501} \theta(t) \cdot \exp\left\{\int_0^t (-\theta(s))ds\right\} \qquad [10]$$

in which: t = completed vacancy duration

To investigate the usefulness of making a distinction between θ_1 and θ_2, we also estimated a dual risk model. In constructing the likelihood for the θ_2 estimate we treated the durations of the vacancies filled by the public employment office as right censored at the point of completion. In the same way for the θ_1 estimate we treated the durations of the vacancies filled by other recruitment channels as right censored observations.

We specified the likelihood for the θ_1 estimate as:

$$L = \prod_{i=1}^{n} \theta_1(t) \cdot \exp\left\{\int_0^t (-\theta_1(s))ds\right\} \prod_{j=1}^{m} \exp\left\{\int_0^t (-\theta_1(s))ds\right\} \qquad [11]$$

in which: n = number of vacancies filled by the public employment office (322)
m = number of vacancies filled in another way (179)

In the same way we specified the likelihood for the θ_2 estimate as:

$$L = \prod_{i=1}^{n} \exp\left\{\int_0^t (-\theta_2(s))ds\right\} \prod_{j=1}^{m} \theta_2(t) \cdot \exp\left\{\int_0^t (-\theta_2(s))ds\right\} \qquad [12]$$

The estimation results of the single and dual risk hazard models are shown in the first three columns of table 3.

We can test whether or not it is useful to make a distinction between θ_1 and θ_2 by applying a likelihood-ratio test (Lindeboom and Theeuwes (1991)). In our case, if $\theta_1 = \theta_2 (= \theta/2)$, the value of the log-likelihood of the competing risk

Table 3. Estimation results

	single risk	θ_1	θ_2
Constant	−2.35 (6.8)**	−3.19 (7.0)**	−2.99 (5.6)**
Log(U/V)	0.17 (2.1)**	0.24 (2.2)**	0.09 (0.7)
Metal/construction	−0.14 (1.0)	−0.08 (0.5)	−0.20 (0.9)
Service-second/high	−0.19 (1.6)	−0.32 (2.1)**	0.06 (0.3)
Firm 10–50 empl.	−0.07 (0.6)	−0.01 (0.1)	−0.13 (0.7)
Firm 50–100 empl.	−0.16 (1.0)	0.02 (0.1)	−0.40 (1.5)
Firm >100 empl.	−0.13 (0.9)	0.11 (0.7)	−0.57 (2.1)**
Reported by phone	0.48 (0.4)	0.00 (0.0)	0.23 (1.0)
Other recr. channel	−0.15 (1.2)	−0.68 (3.6)**	0.53 (2.8)**
Temporary job	0.28 (2.7)**	0.41 (3.1)**	0.03 (0.2)
Parttime job	−0.13 (1.2)	−0.19 (1.4)	0.01 (0.1)
Minimum age req.	0.30 (0.3)	−0.08 (0.6)	0.26 (1.3)
Maximum age req.	−0.44 (0.4)	0.10 (0.7)	−0.31 (1.5)
Employment office A	0.31 (1.7)	0.31 (1.3)	0.29 (1.0)
Employment office B	0.47 (2.0)**	0.63 (2.1)**	0.14 (0.4)
Employment office C	0.13 (0.6)	0.03 (0.1)	0.25 (0.7)
Employment office D	0.46 (2.0)**	0.78 (2.7)**	−0.56 (1.3)
Mediation			
Administr. matching	0.12 (1.0)	0.25 (1.6)	−0.11 (0.6)
Selective matching	0.31 (2.3)**	0.50 (2.9)**	−0.01 (0.0)
Duration effects			
2–4 weeks			
1–2 months			
2–3 months			
3+ months			
Heterogeneity			
$v_2 - v_1$			
γ			
-Loglikelihood	1247.3	920.4	620.5

a) absolute t-values in parentheses
**: significant at 5%-level; *: significant at 10%-level

Table 3. (continued)

	θ_1	θ_2
Constant	−3.81 (5.0)**	−3.75 (6.8)**
Log(U/V)	0.45 (2.9)**	0.11 (0.8)
Metal/construction	0.25 (0.9)	−0.27 (1.1)
Service-second/high	−0.26 (1.3)	0.05 (0.3)
Firm 10–50 empl.	−0.11 (0.4)	−0.14 (0.8)
Firm 50–100 empl.	0.11 (0.4)	−0.51 (1.9)*
Firm >100 empl.	−0.08 (0.3)	−0.62 (2.3)**
Reported by phone	0.13 (0.6)	0.22 (0.9)
Other recr. channel	−0.91 (3.7)**	0.55 (2.9)**
Temporary job	0.65 (3.5)**	0.07 (0.4)
Parttime job	−0.29 (1.5)	−0.05 (0.3)
Minimum age req.	−0.17 (0.8)	0.29 (1.4)
Maximum age req.	0.17 (0.7)	−0.28 (1.4)
Employment office A	0.54 (1.6)	0.38 (1.3)
Employment office B	0.76 (1.7)*	0.20 (0.5)
Employment office C	0.34 (0.8)	0.23 (0.6)
Employment office D	1.35 (3.2)**	−0.55 (1.3)
Mediation		
Administr. matching	0.23 (1.0)	−0.05 (0.2)
Selective matching	0.58 (2.4)**	0.17 (0.7)
Duration effects		
2–4 weeks	0.49 (2.7)**	0.71 (3.3)**
1–2 months	0.70 (2.1)**	0.96 (4.5)**
2–3 months	0.81 (1.4)	1.15 (4.4)**
3+ months	1.47 (2.7)**	0.73 (2.0)**
Heterogeneity		
$v_2 - v_1$	−2.18 (4.2)**	—
γ	0.44 (1.4)	—
-Loglikelihood	914.2	605.7

a) t-values in parentheses
**: significant at 5%-level; *: significant at 10%-level

model, evaluated at the maximum, has to be equal to the value of the single risk model, evaluated at the maximum, plus the logarithm of 1/2 times the number of observations. The value of the likelihood ratio statistic testing for equality of risks is equal to 107.4, which is statistically significant. Therefore, we proceed with the competing risk model, introducing duration dependency and unobserved heterogeneity in both hazard rates:

$$\theta(t|x, v) = \exp\{X'\beta + \alpha.\log(U/V_1) + \textstyle\sum_k \delta_k.I_k(t) + v\} \qquad [13]$$

in which: v = heterogeneity component

In [13] time is measured in weeks, and $I_k(t)$, $k = 1, \ldots, 4$ are time-varying dummy variables which are 1 in the time intervals 2–4 weeks, 1–2, 2–3, 3+

months respectively. Hence we have a flexible duration dependency specification by using a piecewise constant hazard specification. This means that within duration intervals the hazard rate is constant, while it may differ between duration intervals. The heterogeneity component v follows a discrete distribution with two points of support:

$$h(v_1) = p$$

$$h(v_2) = 1 - p \qquad [14]$$

The point of support and the probability p are parameters to be estimated. We have set the constant in [13] equal to v_1, and estimated $v_2 - v_1$, while we reparameterized p as $\exp(\gamma)/\{1 + \exp(\gamma)\}$.

The Maximum Likelihood estimates of the parameters are obtained by using the ML programme GRMAX. The estimation results are shown in the fourth and fifth column of table 3. In θ_2 there appears to be no significant heterogeneity effect, for θ_1 there is a heterogeneity effect. Obviously for both hazard rates there is positive duration dependence. The hazard rates increase rapidly in the first few weeks. A possible explanation for this phenomenon is that employers select their new employee from a pool of applicants, that is created in the first weeks of the vacancy. This explanation is consistent with Van Ours and Ridder (1992, 1993).

Labour market conditions have a significant effect on the hazard rate θ_1: the higher the unemployment-vacancy ratio, the shorter durations of vacancies filled by the public employment office. The value of $\alpha_1 = 0.45$, which is close to the values of Blanchard and Diamond (1989) and Jackman, Layard and Pissarides (1989). The significant influence of the U–V ratio shows that the use of a matching function to analyze the functioning of an employment office is valid. That there is no effect of the U–V ratio on θ_2 may be attributed to the definition of the U–V ratio, which refers to both unemployment and vacancies registered at the public employment offices. Thus the U–V ratio will be an adequate representation of supply-demand conditions at the public employment offices, but not adequate for supply-demand conditions for other search channels.

Only few explanatory variables have comparative coefficients for both hazard rates. The hazard rate θ_2 appears to decrease with firm size. Since there is no effect of firm size on the hazard rate θ_1, this implies that the share of vacancies filled by the public employment office increases with firm size. Vacancies for temporary jobs have a significantly higher θ_1. The indicated use of other recruitment channels has a positive effect on θ_2 and a negative effect on θ_1. As stated before our interpretation of this effect is one of employers' dissatisfaction about the public employment office.

Finally, as expected the intensive mediation methods do not affect θ_2. They have a positive effect on θ_1, although the coefficient of administrative matching is not significant. Intensive matching obviously leads to a significant reduction of the duration of vacancies filled by the public employment office.

5 Conclusions

In the Netherlands the use of the public employment office to recruit new employees has declined in the eighties. Complaints of employers are twofold: applicants are sent too slow and do not fit the requirements of the employer in either ability or motivation. The analysis presented in this article shows that the public employment offices can improve the matching of unemployed and vacancies by applying intensive mediation methods.

From the estimation results it appears that intensive matching leads to a significant reduction of the duration of vacancies filled by the public employment office. Administrative mediation has a positive, though not significant effect. If we consider administrative matching as a method to stimulate job seekers to apply and selective matching as both stimulative and initial screening we may draw some preliminary conclusions. We conclude that it may be necessary to stimulate (unemployed) job seekers to apply. Furthermore, it is effective if the public employment office does some initial screening of candidates on for example motivation. An initial screening on motivation and other aspects seems to be very useful.

The main results of our analysis are twofold. First, it is shown that the matching function is a useful tool in analyzing the process of matching of unemployed and vacancies within the public employment offices. Second, intensive mediation increases the efficiency of this matching process. By increasing this efficiency, public employment offices reduce both the number of vacancies and the number of unemployed.

Appendix 1 Definition of Variables

Vacancy duration: time period between the notification and the filling of a job vacancy

Employment offices A–D: dummies

Occupation (Occupational code of the public employment offices (ARBI-code))
Metal/Construction: ARBI-code 3, 5
Services: ARBI-code 10, 12, 13; Secondary/higher education: Secondary level, higher academic or vocational schooling
Others: ARBI-code 4, 6–9, 11, 14–17, 99

Size of the firm
Size 10–50 employees
Size 50–100 employees
Size > 100 employees
Reference group: Size 0–10 employees

Reported to the public employment office by phone; reference group: reported otherwise

Temporary job; reference group: steady job

Parttime job: less than or equal to 20 hours per week; reference group: more than 20 hours per week

Other recruitment channel: if the employer indicates the use of other recruitment channels; reference group: if the employer indicates that he only uses the public employment office as recruitment channel

Minimum age required: If indicated by the employer
Maximum age required: If indicated by the employer
Reference group: no age requirements

Administrative matching: if the vacancy information is matched with information about registered job seekers
Selective matching: if, additional to administrative matching job seekers are screened with respect to ability, working experience, motivation, etcetera
Reference group: no administrative or intensive matching

Appendix 2 Means of Variables Used in the Analysis

Variable	Vacancy filled by		
	publ e.o.	other wise	total
Administrative matching	0.57	0.51	0.54
Selective matching	0.28	0.26	0.27
Metal/construction	0.33	0.27	0.32
Service-second/high	0.23	0.28	0.25
Other vacancies	0.44	0.45	0.43
Size 0–10 employees	0.39	0.45	0.41
Size 10–50 employees	0.33	0.33	0.33
Size 50–100 employees	0.11	0.11	0.11
Size >100 employees	0.17	0.11	0.15
Reported by phone	0.81	0.86	0.83
Reported otherwise	0.19	0.14	0.17
Steady job	0.53	0.60	0.55
Temporary job	0.47	0.40	0.45
Fulltime job	0.71	0.68	0.70
Parttime job	0.29	0.32	0.30
Other recruitment chan.	0.11	0.27	0.17
No other recr. chan.	0.89	0.73	0.83
Log(U/V)	3.18	3.09	3.14
No age requirements	0.22	0.21	0.22
Minimum age required	0.61	0.69	0.64
Maximum age required	0.75	0.69	0.73
Vacancy duration (weeks)	4.00	5.29	4.43
Total number	322	179	501

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